PCI Express 8-Channel Frame Grabber
User's Manual

Model 812 | Rev.1.0.1 | November 2014

SENSORAY | embedded electronics

Designed and manufactured in the U.S.A

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Table of Contents

TABLE OF CONTENTS 2

LIMITED WARRANTY 3

SPECIAL HANDLING INSTRUCTIONS 4

INTRODUCTION 5

Feature Summary 6

REFERENCE 7

Board Picture and Connector Layout 7

Connector List 8

Connector Pin & Signal Definitions 9

PCI-Express Bus Connector: P1 9

Composite Video Input Connector, DB15: J1 9

Audio Input Connectors, DB15: J2 10

Full A/V (Video & Audio) and Digital I/O Connector: J3 (34-pin) 10

Digital I/O Connectors: TB1 ~ TB9 10

DIP Switches 11

Digital I/O Configuration DIP Switch: SW1 11

LED 12

Power-OK indicators: D1 and D2 12

GPIO Status Indicators: D9 ~ D16 12

SOFTWARE 13

Device Driver and SDK 13

Windows 13

Linux 13

SPECIFICATIONS 15

APPENDIX 16

Appendix A: Cable 812C1 ←→ 812 A/V Break-in Connector Mapping 16

Limited warranty

Sensoray Company, Incorporated (Sensoray) warrants the hardware to be free from defects in material and workmanship and perform to applicable published Sensoray specifications for two years from the date of shipment to purchaser. Sensoray will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The warranty provided herein does not cover equipment subjected to abuse, misuse, accident, alteration, neglect, or unauthorized repair or installation. Sensoray shall have the right of final determination as to the existence and cause of defect.

As for items repaired or replaced under warranty, the warranty shall continue in effect for the remainder of the original warranty period, or for ninety days following date of shipment by Sensoray of the repaired or replaced part, whichever period is longer.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Sensoray will pay the shipping costs of returning to the owner parts that are covered by warranty. A restocking charge of 25% of the product purchase price will be charged for returning a product to stock.

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Special handling instructions

The circuit board contains CMOS circuitry that is sensitive to Electrostatic Discharge (ESD).

Special care should be taken in handling, transporting, and installing circuit board to prevent ESD damage to the board. In particular:

- Do not remove the circuit board from its protective anti-static bag until you are ready to install the board into the enclosure.
- Handle the circuit board only at grounded, ESD protected stations.
- Remove power from the equipment before installing or removing the circuit board.

Introduction

Model 812 is a PCI-Express version of 8-channel frame/video capture device designed for the applications requiring high capture rate from multiple input video channels. It supports capturing from NTSC/PAL/SECAM video sources.

For the need of audio capturing, the Model 812 provides eight channels of monochrome audio capturing associated with eight channels of video respectively.

For each video channel, the capturing frame rate is up to 30 fps for NTSC and 25 fps for PAL/SECAM. It makes total frame/video capturing rate up to 240 fps for NTSC and 200 fps for PAL/SECAM. The capturing resolution can be from followings: D1.N (NTSC), D1.P (PAL), VGA, QVGA, QQVGA, SIF, 2SIF, 4SIF, CIF, QCIF, SQCIF, 4CIF.

For the control and/or alarming purpose, a total of 8-channel general digital I/O signals are provided.

A single +3.3V power supply through PCI-Express bus is required to power the board.

Model 812 is implemented with a single-lane (x1) PCI-Express interface. It can be plugged into any PCI-Express slot on a regular PC or a modular SBC.

Feature Summary

- PCI-Express Video/Audio Capture
- Video input: 8 individual input video channels (Composite)
- Audio input: 8 mono (monochrome) channels
- Resolution (Max): Full-D1:

  NTSC: 720 x 480 @ 30 fps x 8 (Total: 240 fps)
  PAL: 720 x 576 @ 25 fps x 8 (Total: 200 fps)

- Other supported video Resolution:

D1.N:	720 x 480	D1.P:	720 x 576	D.5:	480 x 352
SIF:	352 x 240	2SIF:	704 x 240	4SIF:	704 x 480
VGA:	640 x 480	QVGA:	320 x 240	QQVGA:	160 x 112
CIF:	352 x 288	QCIF:	176 x 144	SQCIF:	128 x 96
4CIF:	704 x 576				

- Frame/Video capturing:

  Raw frame capturing and/or Raw video capturing:

  UYVY/Y422, YUYV/YUY2, YUV420, RGB555/565

  up to 30 fps x 8, for NTSC (Total: 240 fps)
  up to 25 fps x 8, for PAL (Total: 200 fps)

- Audio capturing:

  Raw audio capturing:

  Audio sampling rate: 8 / 16 / 32 / 44.1 / 48KHz
  Audio word length: 8 / 16-bit

- Software encoding:

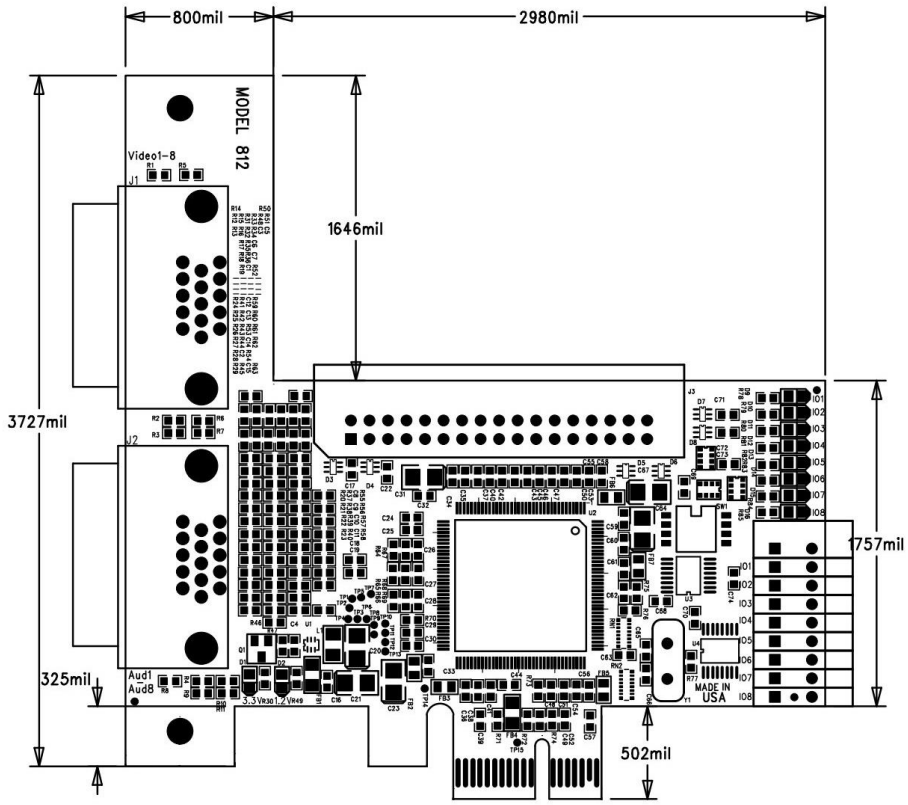
  JPEG frame, MPEG-1/2/4, H.264, or MJPEG A/V capturing:

  Can be done with 3rd party software, or OSS software, library and tools like FFMPEG, MEncoder, GStreamer, and etc.

- 8 digital inputs and/or 8 digital outputs: TTL signals
- Driver and SDK for Windows: XP, Win7, and Win8
- Driver and SDK for Linux: API complies with V4l2

Reference

Board Picture and Connector Layout



Connector List

P1	PCI-Express Connector
J1	DB15: Composite Video Input for Channel-1 to 8
J2	DB15: Audio Input for 8 mono Channel-1 to 8
J3	34-pin Connector: break-in&out, including Composite Video Input for Channel-1, 2, …, and 8 Stereo/mono Audio Input for Channel-1, 2, 3, & 8 Digital Inputs for Channel-1, 2, …, and 8, or Digital Outputs for Channel-1, 2, …, and 8
TB1~TB8	(Optional) General Purpose Digital I/O: configurable Digital Inputs for Channel-1, 2, …, and 8 or Digital Outputs for Channel-1, 2, …, and 8

Connector Pin & Signal Definitions

PCI-Express Bus Connector: P1

Pin – Side B	Signal	Pin – Side A	Signal
B1	+12V	A1	PRSNT#1
B2	+12V	A2	+12V
B3	Reserved *	A3	+12V
B4	Ground	A4	Ground
B5	SMCLK *	A5	TCK*
B6	SMDAT *	A6	TDI *
B7	Ground	A7	TDO*
B8	+3.3V	A8	TMS *
B9	TRST# *	A9	+3.3V
B10	+3.3VAUX *	A10	+3.3V
B11	WAKE# *	A11	PWRGOOD
(C-Key)		(C-Key)	
B12	Reserved *	A12	Ground
B13	Ground	A13	REFCLKP
B14	HSOP0	A14	REFCLKN
B15	HSON0	A15	Ground
B16	Ground	A16	HSIP0
B17	PRSNT#2	A17	HSIN0
B18	Ground	A18	Ground

Note:
* Not Connected
C-Key Connector Key

Composite Video Input Connector, DB15: J1

Pin	Signal	Pin	Signal	Pin	Signal
1	Composite Video In-2	6	Composite Video In-8	11	*
2	Composite Video In-3	7	Composite Video In-7	12	*
3	Composite Video In-4	8	GND	13	*
4	Composite Video In-5	9	GND	14	*
5	Composite Video In-6	10	Composite Video In-1	15	*

Note:
* Not Used

Audio Input Connectors, DB15: J2

Pin	Signal	Pin	Signal	Pin	Signal
1	Audio In-2	6	Audio In-8	11	*
2	Audio In-3	7	Audio In-7	12	*
3	Audio In-4	8	GND	13	*
4	Audio In-5	9	GND	14	*
5	Audio In-6	10	Audio In-1	15	*

Note:* Not Used

Full A/V (Video & Audio) and Digital I/O Connector: J3 (34-pin)

Pin	Signal	Pin	Signal
1	Ground	2	Composite Video Input Channel-1
3	Composite Video Input Channel-2	4	Audio Input Channel-1
5	Audio Input Channel-2	6	Digital Input/Output, GPIO1
7	Digital Input/Output, GPIO2	8	Ground
9	Ground	10	Composite Video Input Channel-3
11	Composite Video Input Channel-4	12	Audio Input Channel-3
13	Audio Input Channel-4	14	Digital Input/Output, GPIO3
15	Digital Input/Output, GPIO4	16	Ground
17	Ground	18	Composite Video Input Channel-5
19	Composite Video Input Channel-6	20	Audio Input Channel-5
21	Audio Input Channel-6	22	Digital Input/Output, GPIO5
23	Digital Input/Output, GPIO6	24	Ground
25	Ground	26	Composite Video Input Channel-7
27	Composite Video Input Channel-8	28	Audio Input Channel-7
29	Audio Input Channel-8	30	Digital Input/Output, GPIO7
31	Digital Input/Output, GPIO8	32	Ground
33	+3.3V (from board)	24	*

Note:* Not Used

Digital I/O Connectors: TB1 ~ TB9

TB	Signal
1	GPIO1 – Digital Input/Output for Channel-1
2	GPIO2 – Digital Input/Output for Channel-2
3	GPIO3 – Digital Input/Output for Channel-3
4	GPIO4 – Digital Input/Output for Channel-4
5	GPIO5 – Digital Input/Output for Channel-5
6	GPIO6 – Digital Input/Output for Channel-6
7	GPIO7 – Digital Input/Output for Channel-7
8	GPIO9 – Digital Input/Output for Channel-8
9	Digital ground

DIP Switches

Digital I/O Configuration DIP Switch: SW1

The DIP switch SW1 is used for configuring Digital I/O routing. Refer to the table below for the routing details:

SW1-1	SW1-2	SW1-3	SW1-4	Description
OFF	X	OFF	X	Disconnect all digital I/O from/to TB1~TB8 and J3 (34-pin) connector
ON	X	OFF	X	Disconnect digital in/out GPIO1~GPIO4 from/to TB1~TB4 and J3 (34-pin) connector
ON	OFF	OFF	X	Route internal GP28~GP31 on the TW6869 to the GPIO5~GPIO8; Connect them to the TB5~TB8 and J3 (34-pin) connector
ON	ON	OFF	X	Route internal GP20~GP23 on the TW6869 as the GPIO5~GPIO8; Connect them to the TB5~TB8 and J3 (34-pin) connector
OFF	X	ON	X	Disconnect digital in/out GPIO5~GPIO8 from/to TB5~TB8 and J3 (34-pin) connector
OFF	X	ON	OFF	Route internal GP24~GP27 on the TW6869 as the GPIO1~GPIO4; Connect them to the TB1~TB4 and J3 (34-pin) connector
OFF	X	ON	ON	Route internal GP16~GP19 on the TW6869 as the GPIO1~GPIO4; Connect them to the TB1~TB4 and J3 (34-pin) connector
ON	X	ON	X	Enable the connectivity for both groups of GPIO1~4 and GPIO5~8 from/to the TB1~TB4 & TB5~TB8, respectively; Also, from/to J3 (34-pin)
ON	OFF	ON	OFF	Route internal GP24~GP31 on the TW6869 as the GPIO1~GPIO8; Connect them to the TB1~TB8 and J3 (34-pin) connector
ON	OFF	ON	ON	Route internal GP28~GP31 on the TW6869 as the GPIO5~GPIO8; Route internal GP16~GP19 on the TW6869 as the GPIO1~GPIO4; Connect the GPIO1~GPIO8 to the TB1~TB8 and J3 (34-pin) connector
ON	ON	ON	OFF	Route internal GP20~GP23 on the TW6869 as the GPIO5~GPIO8; Route internal GP24~GP27 on the TW6869 as the GPIO1~GPIO4; Connect the GPIO1~GPIO8 to the TB1~TB8 and J3 (34-pin) connector

ON	ON	ON	ON	Route internal GP16~GP23 on the TW6869 as the GPIO1~GPIO8; Connect them to the TB1~TB8 and J3 (34-pin) connector

LED

Power-OK indicators: D1 and D2

The LED D1 and D2 are used for indicating on-board Power-OK status.

LED	Description
D1	Main Power, 3.3V Power-OK Status
D2	Core Power, 1.2V Power-OK Status (for the Video Decoder Chipset TW6869, core power status monitoring)

GPIO Status Indicators: D9 ~ D16

The LED D9, D10, …, and D16 are used for indicating the status of the GPIO (General Purpose Digital Input/Output) pin signals, labeled as GPIO1, GPIO2, …, and GPIO8 on the board, and directly connected to the TB1 ~ TB8 and J3 (34-pin) connector's digital in/out pins. A logic '0' (low) turns the LED on and a logic '1' (high) turns it off.

LED	Lable	Signal
D9	GPIO1	Status of GPIO1 ('0' → On and '1' → Off)
D10	GPIO2	Status of GPIO2 ('0' → On and '1' → Off)
D11	GPIO3	Status of GPIO3 ('0' → On and '1' → Off)
D12	GPIO4	Status of GPIO4 ('0' → On and '1' → Off)
D13	GPIO5	Status of GPIO5 ('0' → On and '1' → Off)
D14	GPIO6	Status of GPIO6 ('0' → On and '1' → Off)
D15	GPIO7	Status of GPIO7 ('0' → On and '1' → Off)
D16	GPIO8	Status of GPIO8 ('0' → On and '1' → Off)

Software

Device Driver and SDK

Device driver and SDK including driver API & demo application programs are available for both Windows and Linux.

Windows

Sensoray Company provides 812 WDM driver and DirectX filter for Windows platform. The SDK includes the Windows driver, DLL, Demo application & app source code, etc. It is packaged in a "s812_Vxyz.zip" file for distribution and/or for the customer(s) to download from Sensoray's website.

Refer to the "Model 812 Windows SDK User's Manual" for the SDK, DLL, API, and programming guide details.

Since the driver is a pre-built and based on the WDM BDA and DirectShow oriented architecture, the Microsoft GraphEdit utility can be used for building the A/V preview and/or capturing application. Also, some 3rd party freeware/shareware like VLC player and AMCap software can be used for still/live video capturing and preview.

Linux

The device driver for Linux is provided by Sensoray Company, and supports most of the commonly used or popular Linux distributions, including Ubuntu, Fedora, Linux-Mint, openSUSE, …, etc., with kernel version => 2.6.27. The API complies with standard V4L2 (Video for Linux Version 2), formerly known as V4L (Video for Linux). The API spec and capturing sample program can be downloaded from following websites:

http://www.linuxtv.org/downloads/legacy/video4linux/API/V4L2_API/spec-single/v4l2.html
http://v4l2spec.bytesex.org/
http://v4l2spec.bytesex.org/spec/book1.htm
http://v4l2spec.bytesex.org/spec/capture-example.html

In addition to the application samples from V4L/V4L2, Sensoray Company provides two other customized capturing sample/demo programs that demonstrates raw frame capture and A/V (Video+Audio) capture. Also, a "Sensoray Model 812 Quick-Start Instruction – Linux" manual is provided in a "Linux-812-SDK" package.

For live video preview and/or capturing, commonly used V4L2 application programs like XawTV, VLC, MPlyaer, …, etc., can be used for capturing/previewing from each channel of the 812.

For capturing JPEG frames, MPEG-1/2/4, H.264 or MJPEG video, some 3rd party and OSS libraries/CODECs can be used/integrated in end-user's application programs. As a good example, the FFMPEG (refer to: http://ffmpeg.org/ or http://en.wikipedia.org/wiki/FFmpeg) is

a well-known and highly recommended OSS that can be used for A/V (Video or Audio) capturing, using 812. Sensoray Company provides an application note on how to use the command-line based FFMpeg to capture raw or compressed Video and/or Audio.

Specifications

Video Formats	NTSC, PAL, SECAM
Video Inputs	8 input channels, simultaneously: 8 Composite video, via DB15 connector, 75 Ohms; Or, via a 34-pin connector, 75 Ohms
Audio Inputs	8 input channels, simultaneously: 8 mono for each channel, via DB15 connector; Or, via a 34-pin connector, 75 Ohm Signal level: Line-in level, +/- 1.0V
Capturing Mode	Raw: UYVY/Y422, YUYV/YUY2, YUV420, RGB555/RGB565
Capture rate	Up to: 240 (30x8) frames/sec for NTSC/RS-170/CCIR 200 (25x8) frames/sec for PAL/SECAM
Frame/Video Encoding	Could be done by software and/or 3rd party's CODEC: JPEG, MPEG-1/2/4, MJPEG, and H.264
Resolution	Up to Full-D1: NTSC: 720x480 PAL: 720x576 Supported: D1.N: 720x480 D1.P: 720x576 D.5: 480x352 SIF: 352x240 2SIF: 704x240 4SIF: 704x480 VGA: 640x480 QVGA: 320x240 QQVGA: 160x112 CIF: 352x288 QCIF: 176x144 SQCIF: 128x96 4CIF: 704x576
Digital I/O	8 inputs or 8 outputs: TTL signals configurable inputs/outputs via a 34-pin break-in/out connector via 8 I/O terminal blocks (optional)
Bus	PCI-Express lane x1: Compliant with PCI-Express Base Specification Revision 1.1 and 2.0
OS Platform	Windows and Linux
Power	<1W, +3.3V @ 300mA
Temperature	0 – 70 C
Board Size	4.2" x 4" (107mm x 100mm)

Appendix

Appendix A: Cable 812C1 ←→ 812 A/V Break-in Connector Mapping

Since currently supplied Cable 812C1 (DB15-to-BNC adapting cable for Model 812) is pre-manufactured by 3rd-party company, its label for input channel numbers does not match 812's A/V (Video and/or Audio) channel order.

The chart given below shows the mapping of Cable 812C1 ←→ 812 A/V channel numbers:

A/V Channel No.	Label on Cable
1	Video - 9
2	Video - 14
3	Video - 13
4	Video - 12
5	Video - 11
6	Video - 10
7	Video - 15
8	Video - 16